Aerospace technologies finding down-to-earth applications

Connections made during past Inspection days have led to successful partnerships and to the use of NASA-developed technologies across many non-aerospace industries. Technology developed for space exploration has found application throughout society – from energy, transportation and agriculture to medicine, communications and electronics. Inspection 98 seeks to accelerate these adaptations of space technology.

Success stories describing how attendees have benefited from prior JSC Inspection days include:

Biotechnology

Connections made at Inspection 96 have helped Montana Biotech, a small lab near Yellowstone National Park, begin working with NASA on related technical research. Visitors discovered that their research on extremophiles, bacteria that live in extreme environments, is applicable to NASA's work on handling planetary samples. In preparation for handling Mars samples, NASA and Montana Biotech recently signed a Space Act Agreement under which NASA is studying how to sterilize rock samples containing bacteria, and Montana Biotech is examining these samples to see if they have been successfully sterilized.

Mining

America's coal mining industry could get a high-tech boost from the space program in its efforts to improve efficiency and increase competitiveness.

When members of the National Robotics Engineering Consortium visited Inspection 97, they found help for Joy Mining Co. in developing continuous mining equipment. The NREC is a cooperative venture among NASA, the City of Pittsburgh, the State of Pennsylvania and Carnegie Mellon University established in 1995 to develop products that use advanced mobile robotics technology.

Joy Mining is the largest U.S. producer of continuous equipment used to mine materials such as coal and potash. The NREC is developing add-on automation modules for continuous miners using technologies from JSC. Such equipment could enable the industry to mine shrinking U.S. coal reserves by tapping smaller coal streams that are inaccessible to humans. The NREC describes the potential for automated mining equipment as "enormous."

Energy

Space shuttle technology is at work on the ocean floor in deepwater drilling applications partly as a result of Inspection 97. The event provided an idea for a reliable and less costly solution to a problem that has long plagued the offshore petroleum industry.

Using shuttle docking technology, Bernt Helleso, owner of Houston-based Unitech International, developed a Multi Quick Connector that joins electrical and hydraulic lines to subsea wellheads thousands of feet below the ocean's surface. Where the lines were previously plugged into the wellheads and the connections were opened simultaneously, the new device allows for a two-phase operation, one that first docks and then, with the device securely aligned, engages the connections. Single-step operations often resulted in severe damage, but the new technique has improved reliability in making connections in high-pressure environments.

Medicine

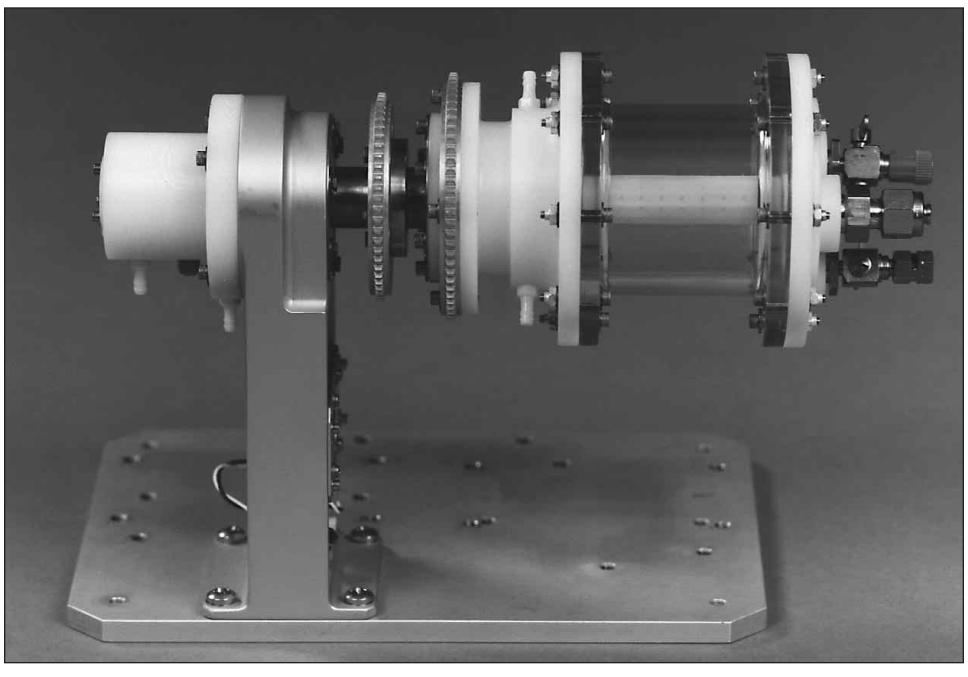
The NASA-developed bioreactor, a rotating cell culture device that allows cells to differentiate into specialized forms, has made many appearances at past Inspection events. The device allows human cells to be grown in such a way that they take on characteristics of those in normal tissues. The breakthrough device could hasten the day when replacement tissues or even whole organs for transplantation could be grown in a culture.

Researchers across the country have found many uses for the bioreactor. One medical researcher is using it to grow gliomas, deadly brain cancers, so that patients' lymphocytes can be "trained" outside the body to attack the tumor before the cells are implanted in the brain. Another microbiologist is using the apparatus to grow lung and liver cells that produce enzymes and other molecular markers normally seen only in intact tissue. And another researcher is growing colon-lining cells and has preliminary evidence that the bioreactor will support the growth of Norwalk virus, an important agent of disease that will not propagate in standard cultures needed for study.

Researchers across the country look forward to the time when bioreactors aboard the International Space Station will be used to grow replacement human organs for transplantation. Experimental results derived from long-term research into the physiology of human beings could produce a windfall to medicine. ■

NASA Photo STS070-301-025

On board STS-70 Astronaut Mary Ellen Weber works with a syringe related to the bioreactor system. The almost weightless state of space travel provides life science researchers with the opportunity to grow cells into three-dimensional tissue pieces that are not achievable using conventional tissue culture methods on Earth. At specified times during the STS-70 mission, crew members injected color producing substances to document fluid movement in the reactor, and various-sized beads to estimate the tissue size that could be supported in the bioreactor.



The bioreactor was developed to keep tissue cultures suspended during the ascent, orbit and entry phases of flight by maintaining them in a state of continual motion, thus preventing tissue damage. These 3-D tissues are crucial to understanding and finding treatments for many diseases including cancer and AIDS.

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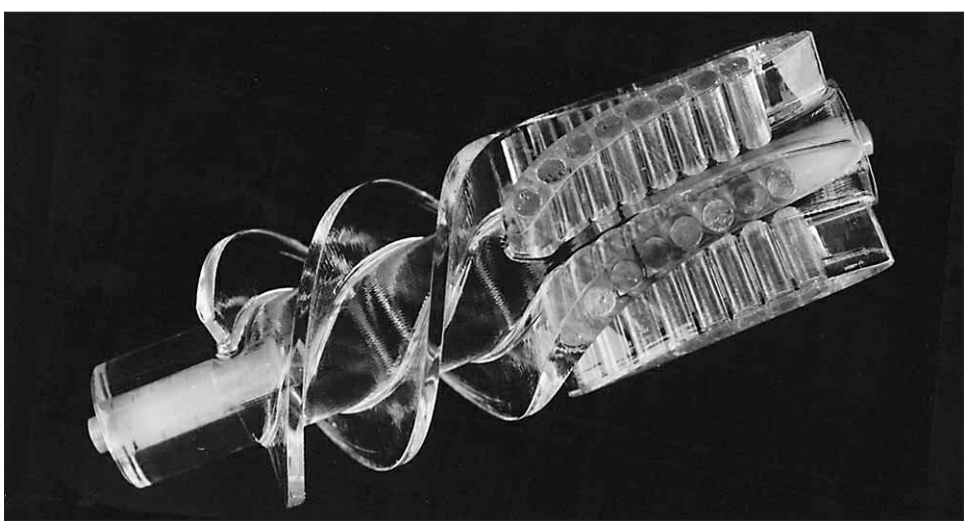

JSC Photo S95-05687

Shown is a side view of the inducer-impeller, a component of a heart pump. This small turbine pump works with the heart's own pumping ability either as a temporary device or as a permanent one. A team of JSC employees and Baylor College of Medicine specialists developed the pump.